Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Petitions Regarding the Use of Signal Boosters and	)	WT Docket No. 10-4
Other Signal Amplification Techniques Used with	)	DA 10-14
Wireless Services	)	

COMMENTS OF VERIZON WIRELESS

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SUMMARY

Verizon Wireless submits these comments in response to the Commission's request for comment on five petitions regarding the use of radio signal boosters, repeaters or amplifiers (collectively "signal boosters") on frequencies licensed under Parts 22, 24, 27 and 90 of the Commission's Rules.

Signal boosters that are marketed and used without a wireless carrier's authorization are a growing and serious cause of harmful interference to wireless networks, threatening both commercial and public safety communications. Data that Verizon Wireless has collected on incidents of repeater interference show that the interference caused by signal boosters ranges from degrading a single digital carrier on a single cell sector, to degrading multiple carriers on multiple sectors and cell sites, such as by causing a reduction in coverage area, to shutting down entire carriers, sectors or cell sites. The harmful interference caused by signal boosters can affect many customers on multiple networks serving the same geographic area, including public safety and national security and emergency preparedness users, and can last for days, often requiring the resources of the Commission to stop it.

These harms to wireless service make prompt Commission action imperative. Given that the use of boosters without carrier authorization is clearly unlawful, the Commission can and should act now to grant CTIA's Petition for Declaratory Ruling, which has been pending since November 2007. CTIA asked the Commission to confirm that the Communications Act and FCC Rules require a license or authorization by a licensee to operate signal boosters in the CMRS bands, and that signal boosters cannot be sold or marketed to customers who have not been authorized to use them.

Verizon Wireless opposes the Wilson Electronics and DAS Forum Petitions. Wilson asks the FCC to find that any person may use a signal booster in the CMRS bands provided that the booster meets FCC equipment certification standards that are designed to prevent interference. The DAS Forum recognizes that licensee approval is required to operate signal boosters, but asks the FCC to adopt guidelines for carrier/user consultation rather than strictly enforcing existing rules or regulating how boosters are marketed.

Wilson argues that mobile signal boosters are akin to wireless handsets and may be operated by subscribers under the wireless carrier's blanket authorization without seeking permission from the licensee. Wilson's arguments, however, are contrary to Section 301 of the Communications Act and the Commission's rules governing commercial mobile radio services, which clearly provide that transmitters, including mobile and fixed signal boosters, can only be operated in CMRS bands by a licensee or an entity authorized by the licensee. Wilson's position is also inconsistent with Enforcement Bureau Notices of Unlicensed Operations stating that a license or licensee permission is required to operate fixed or mobile signal boosters.

Verizon Wireless also disagrees with Wilson's contention that FCC equipment certification standards requiring features such as oscillation protection, amplification shut down, and bi-directional transmitters are sufficient to prevent harmful interference to wireless networks. Verizon Wireless' network has experienced harmful interference from Wilson devices that include the features that Wilson asks the FCC to adopt. Moreover, even if a booster has those features and they work as designed, signal boosters would remain capable of causing harmful interference to Verizon Wireless' network, most commonly through adjacent channel interference and base station receiver overload.

Verizon Wireless also supports CTIA's request for a declaratory ruling that the sale of signal boosters to persons who are not authorized by a carrier to use them is unlawful. Signal boosters today are available for purchase over the Internet or through other outlets. Many entities marketing boosters, however, do not ensure that purchasers are authorized to operate them, and some make misleading claims in their advertising and on their web sites that suggest any purchaser can lawfully install and use them. The Commission should grant CTIA's petition as a means to prevent deceptive marketing practices and stop the sale of unauthorized devices to the public. CTIA's request is similar to the action the Commission recently took banning the sale of wireless microphones operating in the 700 MHz Band. Here, too, Commission action is essential to ensure that wireless networks area able to provide reliable service to the public.

Finally, the Commission should deny the DAS Forum's petition to address the signal booster interference problem through guidelines that would apply to carrier/user consultations. These guidelines are insufficient to prevent the unauthorized use of signal boosters or the harm that they cause to wireless communications.

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COMMENTS OF VERIZON WIRELESS

Verizon Wireless hereby responds to the Commission's request for comment on five Petitions regarding the use of radio signal boosters, repeaters or amplifiers (collectively "signal boosters") on frequencies licensed under Parts 22, 24, 27 and 90 of the Commission's Rules.[1]

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[1] Amendment of Section 90-219 of the Commission's Rules with Regard to the Routine Use of Signal Boosters, filed August 18, 2005 by Bird Technologies Group ("BTG Petition"); Petition for Declaratory Ruling Regarding the Unlawful Sale and User of Cellular Jammers and Wireless Boosters and Repeaters, filed November 2, 2007 by CTIA – The Wireless Association® ("CTIA Petition"); Petition for Declaratory Ruling Regarding the Use of Class B Signal Boosters by Public Safety Entities, filed September 24, 2008 by Jack Daniel DBA Jack Daniel Company ("Jack Daniel Petition"); Petition for Declaratory Ruling Regarding the Unlawful Sale and Use of Cellular Jammers and Wireless Boosters and Repeaters, Petition for Rulemaking, filed October 23, 2009 by the DAS Forum ("DAS Petition"); Amendment of Part 20 of the Commission's Rules to Establish Standards for the Certification of Mobile Power Amplifiers or Handset Amplifiers for Use in the Commercial Mobile Radio Services, Petition for Rulemaking, filed November 3, 2009 by Wilson Electronics ("Wilson Petition"). On January 6, 2010, the Commission consolidated these petitions into a single docket and issued a Public Notice seeking comment on the issues raised in each petition insofar as they pertain to signal boosters. Wireless Telecommunications Bureau Seeks Comment on Petitions Regarding the Use of Signal Boosters and other Signal Amplification Techniques Used with Wireless Services, WT Docket No. 10-4; DA 10-14 (released January 6, 2010) ("Public Notice").

Signal boosters that are marketed and used without a wireless carrier's authorization are a growing and significant source of interference to wireless networks. This interference degrades service, hinders public safety, and wastes carrier resources. The law and FCC rules make clear that signal boosters, including mobile amplifiers, may only be used by licensees or persons authorized by a licensee. In order to enable wireless carriers to protect their networks against interference from signal boosters, the Commission should affirm that operating such devices requires a license or the express approval of a licensee. The Commission should also declare that the sale of repeaters to persons or entities not authorized to operate the devices is unlawful.

I. BACKGROUND

Bird Technologies is a supplier of radiofrequency ("RF") products, systems and services (including signal boosters) to public safety, critical infrastructure, and government clientele. The company is concerned that signal boosters have become consumer devices, operated without the knowledge of the licensee and operated in moving vehicles, causing interference to authorized public safety licensees operating in the 800 MHz bands.[2] In some instances, entire public safety radio site services have been interrupted by signals radiating from recreational vehicles.[3] Bird Technologies asks the Commission to amend Section 90.219 of the Commission's Rules to: (1) make clear that only licensees or those with written authorization from a licensee may operate signal boosters in the Part 90 frequency bands; (2) require that such written authorization include

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[2] Bird Technologies acknowledges that the Commission's efforts to reband the 800 MHz frequencies to segregate the Sprint-Nextel spectrum from public safety spectrum will help alleviate some interference, however, it states that rebanding is only a partial solution. BTG Petition at 9.

[3] *Id.*, at 5-9.

the type of signal booster to be used and the specific location of the booster; (3) place bounds on the amount of amplification that Class B (broadband) signal boosters can produce; (4) require that a warning label stating that only licensees or persons authorized by a licensee may operate the booster be attached to all Part 90 signal boosters; and (5) prohibit the sale or use of mobile signal boosters.[4]

CTIA's Petition seeks FCC action to stop interference to commercial mobile radio services ("CMRS") and public safety networks caused by unauthorized signal boosters.[5] CTIA asks the Commission to declare that (1) the operation of signal boosters is lawful only when the equipment is operated by a licensee or someone authorized by the licensee to operate such equipment; and (2) the sale of wireless signal boosters is authorized only when the sale is made to a licensee or someone authorized by a licensee to operate such equipment.[6]

Jack Daniel seeks a declaratory ruling to clarify how Class B signal boosters may be deployed by public safety licensees in order to eliminate misconceptions in the marketplace. Specifically, Jack Daniel asks the Commission to declare that: (1) Class B signal boosters may be operated by licensees seeking to extend or improve reliable communications; (2) Class B signal boosters may only be deployed in confined locations (i.e., in-building) or in remote locations; (3) power on Class B boosters is limited to 5 watts ERP per channel; (4) operators of

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4 *Id.*, at 9-10.

5 *See* CTIA Petition at 10, n.27; CTIA – The Wireless Association®, White Paper of Wireless Repeaters, appended to CTIA Petition as Attachment 1 ("CTIA Repeaters White Paper"), at Appendix 1.

6 CTIA Petition at 12.

signal boosters are responsible for eliminating all interference caused by their operation; and (5) no separate license is required to operate a Class B signal booster.[7]

The DAS Forum represents major outdoor and indoor distributed antenna system ("DAS") providers as well as manufacturers of equipment used in DAS systems. It argues that FCC Part 2 device certification rules are designed to reduce the possibility of harmful interference to licensed operations and that any devices that have been certified for licensed or unlicensed use may be manufactured and sold without a licensee's consent.[8] It claims that the only relevant issue for FCC consideration, therefore, is whether the Commission should place restrictions on the operation of certified signal boosters, and, if so, the appropriate role that licensees should have in authorizing such operation.[9] Due to concerns that inflexible rules may inhibit its members' businesses, the DAS Forum proposes a code of conduct that would be the only requirement for entities installing or selling a signal booster.[10]

Wilson, a manufacturer of signal boosters, acknowledges that low quality signal boosters can cause interference to both CMRS networks and public safety systems.[11] Wilson, however, argues that, like consumer handsets, mobile signal boosters are included in the CMRS

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7 Jack Daniel Petition at 3.

8 The DAS Forum recognizes, however, that unauthorized low cost or poorly manufactured signal boosters can and do cause harmful interference and that the Commission should explore the best methods of resolving this issue. DAS Petition at 5.

9 *Id.,* at 3.

10 *Id.*, at 6-8.

11 Wilson Petition at 4-5.

authorization held by each licensee.[12] It argues that "[o]peration of mobile amplifiers cannot either cause interference or extend a licensed service area."[13] It contends that the interference issues experienced by CMRS providers can be addressed adequately by stricter certification standards – such as standards to prevent oscillation, to shut down transmission whenever a base station is in close proximity, and to prohibit single-direction amplifiers.[14]

II. DISCUSSION

Verizon Wireless strongly opposes the use of unauthorized signal boosters in the CMRS bands. The unauthorized operation of signal boosters threatens the reliability and quality of mobile services that consumers have come to expect and CMRS providers strive to achieve. Incidents of interference with wireless networks are even more prevalent today than they were when CTIA filed its petition more than two years ago. The Commission should promptly grant the CTIA Petition and affirm that signal boosters, whether fixed or mobile, can only be operated by entities holding a license to operate in the applicable frequency bands, and persons authorized by such licensees. Similarly, the Commission should declare that the sale of signal boosters to

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[12] *Id.*, at 8-9.

[13] *Id.*, at 9.

[14] *Id.*, at 13-17.

entities not licensed or authorized to operate such devices is prohibited.[15] The Commission should deny both the DAS and Wilson Petitions.[16]

A. Boosters and Repeaters Are a Common Source of Interference to Wireless Networks.

The use of signal boosters has caused many incidents of harmful interference to Verizon Wireless' network. These incidents block or degrade service to other customers, including service to public safety service providers, and waste company resources to track, identify, and shut down the sources of interference. Verizon Wireless has collected data on incidents of repeater interference. These data reveal that harmful interference is caused by different booster products manufactured by a number of different companies. The data also reveal that many boosters that cause interference to Verizon Wireless' network are installed by customers of other carriers. The interference caused by signal boosters ranges from degrading a single digital carrier on a single cell sector, to degrading multiple carriers on multiple sectors and cell sites, such as by causing a reduction in the coverage area of a cell sector or cell site, to shutting down carriers, sectors or cell sites entirely. The interference impacts all of the customers on the network, including public safety and national security and emergency preparedness users, and can last

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[15] Verizon Wireless offers two products to customers that desire better in-building coverage. The first, called "Network Extender" is a femto cell product that plugs into a high speed Internet connection and creates a mini base station in the home. This product can be ordered through Verizon Wireless' online store, and is easily installed by the customer. Verizon Wireless also offers a repeater referral program, whereby customers are referred to a third-party vendor that will install a company tested and approved narrow band signal booster in a home or small office location. Both of these solutions are integrated into the wireless network in a manner designed not to cause interference to Verizon Wireless or any other licensee.

[16] Verizon Wireless takes no position on the BTG and Jack Daniel Petitions, both of which deal with boosters deployed in the Part 90 bands.

hours or days, requiring substantial company resources to first identify the source of the interference and then to take steps to stop it.

Data collected by the company include the following:

- In Verizon Wireless' Pacific Northwest region (encompassing the States of Washington, Oregon and Northern Idaho) between January 2006 and July 2009, there were 71 reported incidents of interference from radio frequency devices, the vast majority of which were from unauthorized signal boosters. Of these incidents, 22 were determined to come from mobile boosters. Investigating and resolving these booster interference issues required more than 900 network engineering man hours.

- The Mountain region (Montana, Southern Idaho, Wyoming, Northern Utah and Colorado), between August of 2005 and December of 2009, reported 53 incidents of interference from radio frequency devices (primarily unauthorized signal boosters). Ten of the boosters involved were mobile signal boosters. Investigating and resolving these booster interference issues also required more than 900 network engineering man hours.

- The Georgia/Alabama region (Georgia and most of Alabama), between December of 2006 and July of 2007, reported 9 confirmed incidents of repeater interference. Investigating and resolving these booster interference issues required over 200 network engineering man hours.

Particular incidents of signal booster interference include:

- An incident in 2006 in New York City where a signal booster installed in a Manhattan office building interfered with about 200 cell sites, including some across the river in New Jersey.

- An incident in January, 2009 in Cheyenne, Wyoming, where a Wilson Smart Tech BDA, installed in a vehicle, caused interference to a digital carrier on 5 cell sectors at 3 cell sites. The interference lasted more than 6 hours.

- An incident in September, 2007 in Honolulu, Hawaii, where 3 Digital Antenna Powermax boosters installed in a harbor ferry caused intermittent interference to multiple cell sectors over 8 days.

- A December, 2008 incident in Seattle, Washington, where a Digital Antenna Powermax booster installed on a boat impaired a digital carrier on 3 cell sectors at one cell site causing an estimated loss of 30,000 minutes of use over 7 hours.

- A February, 2008 incident in Tucson, Arizona, where a Cyfre dual-band cell booster installed in a vehicle by a customer of another carrier negatively affected 16 cell sites by preventing calls from originating on several sectors over a two-day period.

- A March, 2009 incident in Fort Morgan, Colorado, where a Wilson Smart Tech amplifier installed in a building caused interference to one digital carrier at 4 cell sites over a period of 7 days.

While these data illustrate the range and magnitude of the problems caused by unauthorized signal boosters, they are the tip of the iceberg. Because signal booster interference may be sporadic, may be caused by boosters installed in moving vehicles or boats (making them nearly impossible to investigate), or because the company lacks the resources to investigate every incident of interference, most incidents of harmful interference caused by boosters cannot be studied.[17]

It is clear from these data and examples that interference from unauthorized signal boosters, both fixed and mobile, causes significant harm to wireless networks and costs carriers thousands of hours to investigate and, where possible, resolve the interference. To help prevent this interference, the Commission needs to (1) confirm that signal boosters cannot be operated without a license or licensee approval, and (2) declare that signal boosters cannot be sold to entities not authorized to operate them.

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[17] Verizon Wireless engineers are constantly monitoring the performance of the network through various metrics, such as dropped calls or ineffective call attempts. If the company notices that particular cell sites, cell sectors or digital carriers (blocks of frequency used in providing CDMA service) are experiencing elevated levels of blocking or dropped calls over a significant period of time, and there is no external known cause for the spike (such as an emergency situation in the area), network engineers will be dispatched to investigate. These investigators use equipment designed to find the source of the interfering signal. However, if the interference source is mobile, or if the interference is sporadic, it is unlikely that the interference source will be determined.

B. The Communications Act and Commission Rules Make Clear that Boosters and Repeaters Cannot Be Operated Without a License.

The Communications Act and the Commission's rules governing CMRS bands are clear that radio transmitters that operate in CMRS bands may be operated only by, or under the control of, a licensed entity. Section 301 of the Communications Act prohibits any person from using or operating any apparatus for the transmission of energy or communications or signals by radio without a license.[18] The Commission's rules governing the operation of cellular and PCS systems help to implement this provision.

Sections 1.903 and 22.3 of the Commission's rules contain similar language limiting the operation of stations in the Wireless Radio Services (1.903) and Public Mobile Services (22.3). Specifically, these sections provide that "stations" can "be used and operated only in accordance…with a valid authorization granted by the Commission."[19] The Commission defines "radio station" as a "separate transmitter or a group of transmitters under simultaneous common control, including accessory equipment required for carrying on a radio communications service."[20] Because signal boosters are transmitters, the operation of these devices requires a license.[21]

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18 47 U.S.C. § 301 ("No person shall use or operate any apparatus for the transmission of energy or communications or signals by radio…except under and in accordance with this Act and with a license in that behalf granted under the provisions of this Act.").

19 47 C.F.R. §§ 1.903, 22.3. Cellular, PCS, AWS and 700 MHz services are Wireless Radio Services. *See* 47 C.F.R. § 1.907 (defining Wireless Radio Services as "all radio services authorized in parts…22 [cellular], 24 [PCS and] 27[AWS and 700 MHz]").

20 47 C.F.R. § 1.907.

21 *See* Public Notice at 1, n.2 ("Generally, signal boosters are treated as licensed transmitting devices and must go through the equipment certification process outline[d] in Part 2 of the Commission's Rules.").

Commission rules state that a wireless provider's license provides "blanket" authority for a variety of transmitters operating within the licensee's geographic area and frequency band, so long as certain conditions are met. For example, under certain circumstances, additional transmitters designed to fill out a service area may be operated without a separate license.[22] These exceptions, however, apply only to transmitters under the control of the licensee.[23] The cellular rules also provide that licensees may install and operate in-building radiation systems[24] without applying for authorization or notifying the Commission.[25] Only if the signal boosters are under the control of the underlying wireless carrier, however, may they lawfully be operated without obtaining a specific license from the Commission.[26]

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22 47 C.F.R. § 22.165. Similarly, the Commission's PCS Rules provide that "Blanket licenses are granted for each market and frequency block. Applications for individual sites are not required and will not be accepted." 47 C.F.R. § 24.11(b). Part 27 of the Commission's Rules contains a similar provision. *See* 47 C.F.R. § 27.11(a) ("Applications for individual sites are not required and will not be accepted, except where required for environmental assessments . . ."

23 *Revision of Part 22 of the Commission's Rules Governing the Public Mobile Services*, Report and Order, 9 FCC Rcd 6513, ¶ 22 (1994).

24 An "in-building radiation system" is "a supplementary system comprised of low power transmitters, receivers, indoor antennas and/or leaky coaxial cable radiators designed to improve service reliability inside buildings or structures located with the service areas of stations in the Public Mobile Services." 47 C.F.R. § 22.99.

25 *See* 47 C.F.R. § 22.383 ("Licensees may install and operate in-building radiation systems without applying for authorization or notifying the FCC, provided that the locations of the in-building radiation systems are within the protected service area of the licensee's authorized transmitter(s) on the same channel or channel block").

26 *See* Public Notice at 1, n.2 ("Additionally, the Commission's rules and policies adopted pursuant to Section 310(d) require that licensees maintain control over and responsibility for their assigned spectrum, equipment and authorizations. Similarly, Section 1.903 established that stations in wireless services may only be operated with an FCC authorization (*i.e.* license). The rules applicable to Part 22 Cellular and Part 90 Specialized Mobile Radio (SMR) services specifically state that licensees can use signal boosters, in-building radiation systems and repeaters.")

All of the Petitioners except Wilson appear to agree that signal boosters, whether fixed or mobile, can only be operated by a licensee or an entity authorized by the licensee.[27] Wilson alone argues that mobile signal boosters can be operated on licensed frequency bands without either a license or permission of a licensee. Wilson argues that authority for subscribers to operate mobile signal boosters is derived from Section 1.903(c) and 22.3(b) of the Commission's Rules, which provide that "[a]uthority for subscribers to operate mobile or fixed stations . . . is included in the authorization held by the licensee providing service to them."[28] By distinguishing mobile signal boosters as akin to a handset, Wilson argues that subscribers that use mobile boosters "are considered to be operating their mobile stations – including handsets amplifiers – not only under their service providers' authorization, but under the authorization of any licensee that temporarily provides their service."[29]

Wilson's arguments that mobile amplifiers are different legally from fixed boosters fail on every level. First, the Commission, through Notices issued by the Enforcement Bureau, has determined that signal boosters, whether installed in mobile or fixed locations, may not be operated by non-licensees unless such operation is authorized by the licensee. Citing to Section 301 of the Communications Act and Section 22.283 of the Commission's Rules, the Bureau has

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27 *See* CTIA Petition at 10-14, CTIA White Paper at 2-11; BTG Petition at 8; Jack Daniel Petition at 3; DAS Petition at 7 ("Coordination with the carrier(s) showing no likelihood of harmful interference shall be considered licensee consent to operate the equipment.")

28 Wilson Petition at 8, *citing* 47 C.F.R. §§ 1.903(c); 22.3(b).

29 *Id.*, at 8-9, *citing* 47 C.F.R. §§ 22.571, 22.927 (requiring licensees to maintain operational control over mobile stations operated by subscribers, including subscribers of a different carrier temporarily receiving service from the licensee).

repeatedly stated "[a] licensee's authority to install a [bi-directional amplifier] does not, without further authorization from the licensee, permit a subscriber to install a BDA."[30]

Second, there is no sound legal basis for distinguishing between mobile amplifiers and all other signal boosters. Indeed, the very rules Wilson cites to argue that mobile boosters may lawfully be operated by subscribers without separate approval from the licensee do not distinguish between fixed and mobile stations.[31] Wilson contends that other rule sections indicating that only licensees can operate signal boosters only apply to fixed boosters, and that Sections 1.903(c) and 22.3(b) distinguish mobile boosters from fixed. However, given that the language in those sections applies to both mobile and fixed stations, they cannot be read to approve the use of mobile boosters by subscribers.[32]

Third, Wilson's interpretation of the law contradicts the requirements of other FCC rule sections. Section 22.927, for example, makes cellular carriers "responsible for exercising

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30 Federal Communications Commission, Enforcement Bureau, South Central Region, *Notice of Unlicensed Operation*, Case Number EB-08-NF-0029 (August 20, 2008) (action regarding interference to Verizon Wireless caused by a cell phone booster installed in a private residence in Greensboro, NC); Federal Communications Commission, Enforcement Bureau, Western Region, *Notice of Unlicensed Operation*, Case Number EB-08-LA-0295 (October 24, 2008) (action regarding interference to Verizon Wireless from a BDA installed in a building in Santa Fe Springs, CA; Federal Communications Commission, Enforcement Bureau, South Central Region, *Warning Notice*, Case Number EB-08-MA-0201 (November 17, 2008) (action regarding interference to AT&T Mobility caused by a BDA installed on a boat in Fort Lauderdale, FL).

31 *See* 47 C.F.R. §§ 1.903(c), 22.3(b) ("Authority for subscribers to operate *mobile or fixed stations* . . . is included in the authorization held by the licensee providing service to them").

32 The Public Notice soliciting comments on the booster petitions likewise does not distinguish between mobile and fixed boosters. Public Notice at 1, n.1 (stating that the term "signal booster . . . is intended to include all manner of amplifiers, repeaters, boosters, distributed antenna sysyems, and in-building radiation systems that serve to amplify CMRS device signals, Part 90 device signals, or extend the coverage area of CMRS providers or Part 90 service licensees").

effective operational control over mobile stations receiving service through their cellular systems."[33] Section 22.305 makes Public Mobile Station licensees "responsible for proper operation and maintenance of their stations, and for compliance with FCC rules."[34] Other rule sections make licensees responsible for compliance with technical specifications that limit the potential for interference with adjacent licensees. These include limits on effective radiated power (ERP)[35] and limits on spurious emissions.[36] It is not possible for a licensee to comply with these and other rule requirements if the licensee does not know what equipment is being used on licensed frequencies and where such equipment is being used.

The Communications Act and FCC rules are clear that a license is required to operate transmitters, including both fixed and mobile signal boosters. The Commission should thus grant CTIA's petition as well as the other petitions that ask for a declaratory ruling to confirm existing law.[37]

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33 47 C.F.R. § 22.927.

34 47 C.F.R. § 22.305.

35 47 C.F.R. §§ 22.913, 24.232, 27.50.

36 47 C.F.R. §§ 22.917, 24.238, 27.53.

37 While Verizon Wireless believes that there is absolutely no question that existing law prohibits the authorization of boosters by parties not authorized by the licensee, the fact that Wilson continues to assert the law is to the contrary necessitates a ruling. However, given that the Commission merely needs to confirm current law, it should grant CTIA's request on this issue immediately, and then proceed to consider other issues presented by the petitions.

C. Device Standards for Boosters Are Not Sufficient to Prevent Harmful Interference.

Wilson argues "that no carrier has shown how the use of a properly-designed broadband handset amplifier can harm a wireless network." It contends that the interference issues experienced by CMRS providers can be addressed adequately by stricter certification standards – such as standards to prevent oscillation, to switch off both forward and reverse link amplification whenever a base station is in close proximity, and to prohibit single-direction amplifiers. Any devices that meet Commission certification standards could then be used by anyone on licensed frequency bands.[38] Verizon Wireless disagrees that device features alone are sufficient to address carrier interference concerns, and thus opposes Wilson's petition for a rulemaking.

1. Verizon Wireless Has Experienced Interference from Boosters that Have the Features Wilson Claims Will Prevent Interference.

The features Wilson touts as means of preventing interference do not reliably work. At least four of the interference incidents noted above were caused by Wilson BDAs employing "Smart Tech" technology. According to Wilson, this technology enables bi-directional amplifiers to automatically prevent oscillations and adjust their power based on the cell site's requirements, thus preventing overload of the carrier's network or interference with other users on the system."[39] Wilson's "Smart Tech" amplifiers include the features -- oscillation control, amplification control, and bi-directional -- that Wilson claims the FCC should adopt to prevent

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[38] Wilson Petition at 13-17.

[39] Wilson Electronics, Inc., "Wilson Electronics has a solution for improving your indoor cellular coverage and signal quality," Press Release, 2007 (available at: http://www.wilsonelectronics.com/spanish/Files/Media/801105.pdf).

harmful interference. The fact that these features did not work to prevent interference in at least some incidents shows that device standards alone are not sufficient to prevent interference.

2. Even Properly Functioning Boosters Can Cause Interference to Wireless Networks.

Even if a booster's design features work properly, fixed and mobile signal boosters can and do cause harmful interference to wireless networks. Signal boosters, including the mobile boosters Wilson asks the FCC to approve, generate noise which can render wireless networks completely inoperable in their vicinity. This noise has two distinct manifestations in the wireless network.[40]

a) Adjacent-Channel Noise Rise

The first noise problem is related to the classical "near-far" problem in cellular networks. In the "near-far" case, a subscriber is "far" from the base station providing wireless service, but simultaneously "near" a base station of a different wireless service provider using an adjacent frequency block. Being far from the serving base station, the subscriber uses maximum transmit power to be heard by the network, thereby potentially causing adjacent-channel interference to the other service provider's base station.

If the "far" subscriber is using a mobile booster (and this is exactly the situation a mobile booster is marketed to remedy), even higher transmitter power is available, worsening the adjacent channel interference problem. But an additional problem is also present—the

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[40] The forms of interference caused by signal boosters discussed in this section exist whether the booster is fixed or mobile. The problems are more pronounced, however, with mobile boosters because, unlike fixed boosters which operate in a constant manner and can be more readily detected and integrated into a wireless network, the interference caused by mobile boosters changes (and therefore cannot be accounted for) as the mobile travels in relation to network base stations.

generation of broadband noise by the booster. All amplifiers generate broadband noise at their output, from a combination of the amplification of noise sources at their input (such as thermal noise) and from the additive noise of the active electronics that make up the amplifier.[41] Because most signal boosters are designed to work on all wireless carrier frequency bands, this noise is received on both the serving carrier frequency bands and adjacent carrier bands.

To illustrate, assume an A-side cellular subscriber is using a Wilson mobile booster,[42] and the subscriber is far from the A-side serving base station but near the cellular B-side licensee's base station. The mobile booster amplifies the A-side subscriber's unit uplink signal as designed, but, because the booster is designed to boost both A- and B-side cellular signals, it also generates noise (Nout) over the B-side frequency range. Applying the formula described above, the mobile booster will generate noise at -69 dBm signal strength into the nearby B-side cellular base station. This noise signal cannot be rejected by filters at the base station and has the effect of raising the effective noise floor at the base station, thus reducing the coverage and capacity of all users of that base station.[43] This impact would be seen from mobile boosters traveling within

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41 The noise power output from any amplifier can be calculated using the formula: Nout = FGkTB, where Nout = noise power output in watts, F = "noise figure" of the amplifier (this is a measure of the noise internally generated by the amplifier), G = gain of the amplifier, K = Boltzmann's constant (1.38e-23 watts/Hz-K), T = temperature (degrees Kelvin), and B = bandwidth (Hz). Friis, H., "Noise Figure in Radio Receivers", Proceedings of the IRE, July 1944, pp. 419-422.

42 Wilson model 801101, with specifications given as F = 4 dB, and G = 40 dB. 4 dB is Wilson Electronics' quoted noise figure for the receive (downlink) amplifier. The transmit (uplink) amplifier almost certainly has a higher noise figure than this, as transmitters are rarely optimized for noise figure. A more realistic figure would probably be 10-15 dB, with a corresponding increase in the generated noise power output.

43 Assuming a typical CDMA base station typical noise floor of around -111 dBm, the -69 dBm noise signal from the mobile booster would raise the effective noise floor by 1 dB.

several hundred meters of the B-side base station. Moreover, because many boosters have higher actual gains or transmitter noise figures than the figures used in this example, the impacts from such boosters will be seen at distances further from the adjacent carrier base stations. [44]

b) CDMA Base Station Receiver Overload

Signal boosters can also cause problems for CDMA base stations that are actively serving that subscriber. CDMA systems use multiple power control loops to keep the received power level from all served subscriber units at the base station receiver at the same level. On the reverse link, the power control loops have at least 73 dB of dynamic range (from +23 dBm maximum subscriber transmit power to -50 dBm minimum) to match the range of pathloss commonly experienced as the subscriber travels throughout any given cell's coverage area. The introduction of the booster as a gain element within the power control loop increases the minimum transmit power of the subscriber, which is destructive to a CDMA (or any spread-spectrum) system.

For example, assume a subscriber with a booster is near the serving CDMA base station. The base station sends commands to power down the subscriber to the minimum -50 dBm, but because of the gain element (the booster), the subscriber actually transmits at -40 dBm (10 dB gain in the booster). This additional 10 dB of received signal obliterates the received signals of the other subscribers on that CDMA channel. In response to this 10 dB signal rise, all other subscribers must raise their transmit power by 10 dB (thus re-equalizing all subscribers' received powers at the base station). If they cannot, they are "dropped" by the serving base station as

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[44] In-building systems can have even larger negative impacts, since typically their gains are higher, and they use gain antennas for the link to the "far" base station.

being unserviceable. Effectively the coverage and capacity of the serving base station is reduced significantly due to the presence of a single subscriber with a booster.

In both of these scenarios, adjacent channel noise rise and base station receive overload, the subscriber with the booster notices no ill effects. The impact is only on other users of the system as well as potentially on users of overlapping systems serving the same geographic area. This fact makes it more difficult for carriers to convince the offending subscriber to shut-down the booster.

As demonstrated above, signal boosters can and do cause harmful interference to wireless networks. This interference occurs even with boosters designed with the features Wilson claims will prevent harmful interference, and even if those features are operating properly. For this reason, these features cannot be relied upon to prevent harmful interference into wireless networks, and Wilson's petition to allow their marketing should be denied.

D. Verizon Wireless Thoroughly Considered Wilson's Request to Approve its Mobile Signal Booster for Use on Its Network.

Wilson argues that FCC device standards are necessary, in part, because companies like Verizon Wireless do not have standards in place, which, if met, would automatically approve signal boosters for use on the carrier's network.[45] It claims that it spent over 18 months trying to get its mobile amplifiers approved for use on the Verizon Wireless network.[46]

Contrary to Wilson's claims, Verizon Wireless thoroughly considered Wilson's request to have a mobile signal booster approved for use on the Verizon Wireless network. Because, as

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[45] Wilson Petition at 16. *Id.*, at 11-12.

[46] *Id.*, at 11-12.

discussed above, equipment standards alone are not sufficient to prevent harmful interference to wireless networks, Verizon Wireless could not satisfy Wilson's request for a set of standards for automatically approving its mobile booster. Ultimately, after multiple reviews of the Wilson product, Verizon Wireless determined that the Wilson booster could not be approved for use on the Verizon Wireless network. This decision was based on several reasons, including the adjacent channel noise rise and base station receiver overload problems, a concern that the Wilson products' anti-oscillation feature does not always work to prevent interference (as discussed above), and its ability to operate on bands outside of Verizon Wireless' licensed frequencies. Verizon Wireless encouraged Wilson Electronics to consider employing a third party testing company for further evaluation of its products as they evolved their technology and provided Wilson the name of an independent laboratory for such evaluations although, to Verizon Wireless' knowledge, Wilson has not availed itself of this process.

Wilson's issue with Verizon Wireless' consideration of Wilson's mobile booster is very similar to the issues it raises in its petition. Wilson wants carriers (or the Commission to adopt and publish objective design standards for mobile signal boosters which would allow devices meeting them to be sold to any customer. As discussed above, however, design standards alone are not sufficient to protect against harmful interference.

E. The FCC Should Declare that the Sale of Boosters and Repeaters to Entities Not Authorized to Operate them Is Unlawful.

CTIA requests a declaratory ruling by the Commission that signal boosters may not be lawfully marketed to entities that do not have authority to operate them. CTIA bases its request,

in part, on language in Section 302(b) of the Act.[47] Section 302(b) vests authority in the FCC to promulgate rules regarding the manufacture, importation, and marketing of devices and equipment capable of causing interference. The section also prohibits marketing devices or equipment that fail to comply with FCC rules adopted pursuant to this authority.[48] CTIA argues that because FCC rules promulgated pursuant to this authority prevent operation of devices by non-licensees, then sale of devices to such persons would violate the statute.[49]

Verizon Wireless supports CTIA's request for a declaratory ruling regarding the marketing and sale of signal boosters. CTIA's request is very similar to the action the Commission recently took with respect to wireless microphones operating in the 700 MHz Band.[50] There, based on a finding that wireless microphones "could interfere with public safety and commercial base and mobile receivers,"[51] the Commission prohibited the "manufacture, import, sale, lease, offer for sale or lease, or shipment of low power auxiliary stations for operation in the 700 MHz Band in the United States . . ."[52] The Commission reasoned that this

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47 CTIA Repeaters White Paper at 9-11. CTIA also argues that sale of repeaters to unauthorized users violates Section 333 of the Act. CTIA Petition at 12-14.

48 47 U.S.C. § 302(b).

49 CTIA Repeaters White Paper at 9-11.

50 Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band, WT Docket No. 08-166; Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition, WT Docket No. 08-167; Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones, ET Docket No. 10-24, *Report and Order and Further Notice of Proposed Rulemaking*, FCC 10-16 (released January 15, 2010) ("Wireless Microphone Order").

51 *Id.*, at 21-22 (paras. 37-38).

52 *Id.*, at 30 (para. 59).

manufacturing and marketing ban was "necessary to ensure that new services in this valuable spectrum will be provided without interruption to benefit all Americans."[53]

As discussed above, like wireless microphones, interference from unauthorized signal boosters is a significant problem, and one that will worsen until the FCC prevents signal boosters from being sold to unauthorized persons.[54] Today mobile and fixed signal boosters are available via the Internet from any number of vendors.[55] These vendors sell signal boosters for homes, offices, large buildings/campuses and mobile use.[56] For the most part, these vendors do not state any limits on the use of the products they sell.[57] The websites visited either say nothing with respect to a purchaser's authorization to operate the devices,[58] merely represent that the devices

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53 *Id.*, at 30 (para. 61).

54 In May, 2008, the Spectrum Enforcement Division of the FCC's Enforcement Bureau, found Digital Antenna, Inc. apparently liable for failing adequately to respond to a Letter of Inquiry investigating, *inter alia,* Digital Antenna's practice of "marketing its boosters/repeaters to end users who are neither licensed cellular or PCS providers nor authorized by their licensed cellular or PCS provider to operate the device on the provider's network . . ." In the Matter of Digital Antenna, Inc., Sunrise, Florida, *Notice of Apparent Liability for Forfeiture and Order*, File No. EB-07-SE-390, NAL/Acct. No. 200832100045, FRN # 0005061015 (released May 12, 2008), at 1. Implicit in this proceeding is the Enforcement Bureau's position that marketing signal boosters to non-licensees is unlawful. .

55 *See* www.CellAntenna.com; www.wilsonelectronics.com; www.repeaterstore.com; www.unwiredsignal.com; www.mycellularsolutions.com; www.spotwave.com.

56 *Id.*

57 The sales practices of many signal booster vendors also violate Section 2.927(c) of the Commission's Rules, which prohibits persons from making "reference to an equipment authorization in a deceptive or misleading manner or convey[ing] the impression that such equipment authorization reflects more than a Commission determination that the device or product has been shown to be capable of compliance with the applicable technical standards of the Commission's rules." 47 C.F.R. § 2.927(c).

58 *See* www.CellAntenna.com.

sold are "FCC type accepted,"[59] or affirmatively state that the devices may be legally operated because they are FCC certified.[60] These claims are obviously intended to mislead customers into believing that they can lawfully install and use these devices. In the absence of a declaration by the FCC that signal boosters can only be sold to licensees or those authorized by licensees, the unlawful sale and use of unauthorized boosters will continue to spread.

F. The DAS Petition Proposal to Adopt Consultation Guidelines Is Inadequate to Prevent Interference.

The DAS Forum proposes a code of conduct that would be the only requirement for entities installing or selling a signal booster. Under this code, (1) the sale of signal boosters would be accompanied by a notice stating that it is the responsibility of the owner/installer to coordinate with the appropriate local carrier(s) prior to operation to avoid harmful interference; (2) as part of the coordination process, the owner/installer of the equipment shall provide the carrier with the FCC certification number of the equipment to be used, the location where it is to be installed, and other technical information to demonstrate that it is unlikely to cause interference; (3) coordination with the relevant carrier(s) showing no likelihood of harmful

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59 *See* http://www.wilsonelectronics.com//ViewProduct.php?ID=5.

60 *See* http://www.unwiredsignal.com/?view=Cell-Phone-Booster-Repeater-FAQ ("Are cellular repeaters legal? Wilson's are and their's is the only brand we carry. Legal and FCC approved."); http://www.repeaterstore.com/legal-notice.html ("All active amplifying (repeater) products sold on this websites [sic] are licensed to operate on their appropriate bands by the Federal Communications Commission (FCC). Details of these licenses can be found on the FCC website, under the 'Grantee Code' UM8"). Of the sites visited, only Spotwave acknowledged that carrier approval is necessary to operate the signal booster – but only if the visitor to the website clicked through several menus to find the "terms and conditions" page. http://www.spotwave.com/about/policies/terms.asp.

interference shall be considered licensee consent to operate the equipment; and (4) the owner/operator of the equipment is responsible for eliminating any actual harmful interference.[61] Verizon Wireless opposes the DAS Petition guidelines proposal. While aspects of the proposal, such as requiring a notice to be attached to all signal boosters making clear that they may not be operated without a license, are a step in the right direction, many other aspects of the proposal are inadequate to prevent interference. In particular, information about what type of equipment will be installed and where it will be installed is insufficient to allow a carrier to determine whether interference will occur. Carriers need to be able to review factors such as precisely where within a premises and how the equipment will be installed, and need to factor in the location and characteristics of other transmitters in the area – to guard against adjacent channel interference and base station receiver overload -- to determine the interference potential of a booster or system of boosters.

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[61] *Id.*, at 6-8.

III. CONCLUSION

Signal boosters that are marketed and used without carrier authorization are a growing and serious source of harmful interference to wireless networks. Under existing law, signal boosters, including both fixed and mobile amplifiers, may only be used in CMRS bands by licensees or persons authorized by a licensee. In order to prevent interference from unauthorized signal boosters, the Commission should grant the CTIA Petition and confirm that only licensees or those authorized by licensees may operate signal boosters on the licensee's frequency bands. The Commission should also declare that the sale of repeaters to persons or entities who have not been authorized by a carrier to operate the devices is unlawful.

Respectfully submitted,

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Certificate of Service

I hereby certify that on this 4th day of February copies of the foregoing "Comments of Verizon Wireless" in WT Docket 10-4 were sent by US Mail to the following parties:

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